

## MISCELLANEOUS PIPE AND FITTINGS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Requirements for providing miscellaneous pipe and fittings as indicated. Miscellaneous pipe and fittings include all aluminum, copper, brass, plastic, cast-iron soil and lined steel pipe and fittings.
- B. Related Work Specified In Other Sections Includes:
  - 1. Storm Water Pump Station
  - 2. Leakage Tests
  - 3. Painting
  - 4. Ductile Iron Pipe and Fittings
  - 5. Steel Pipe and Fittings

#### 1.2 REFERENCES

- A. Codes and standards referred to in this Section are:

- |                   |  |
|-------------------|--|
| 1. ASTM A 74      | - Specification for Cast Iron Soil Pipe and Fittings   |
| 2. ASTM B 26/B26M | - Aluminum Alloy Sand Castings   |
| 3. ASTM B 32      | - Specification for Solder Metal   |
| 4. ASTM B 42      | - Specification for Seamless Copper Pipe, Standard Sizes   |
| 5. ASTM B 43      | - Specification for Seamless Red Brass Pipe, Standard Sizes  |
| 6. ASTM B 108     | - Specification for Aluminum Alloy Permanent Mold Castings   |
| 7. ASTM B 241     | - Specification for Aluminum and Aluminum Alloy Seamless Pipe and Seamless Extruded Tube                               |
| 8. ASTM C 564     | - Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings  |
| 9. ASTM D 1784    | - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds |
| 10. ASTM D 1785   | - Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120                                |
| 11. ASTM D 2464   | - Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80                            |
| 12. ASTM D 2564   | - Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems                             |
| 13. ASTM D 2855   | - Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings           |

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|-----|------------------|--|
| 14. | ASTM F 491       | - Specification for Poly (Vinylidene Fluoride) (PVDF) Plastic-Lined Ferrous Metal Pipe and Fittings          |
| 15. | ASTM F 492       | - Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings           |
| 16. | ASTM F 599       | - Specification for Poly (Vinylidene Chloride) (PVDC) Plastic-Lined Ferrous Metal Pipe and Fittings          |
| 17. | ASME B1.20.1     | - Screw Threads - Pipe Threads, General Purpose (Inch)   |
| 18. | ASME B16.15      | - Cast Bronze Threaded Fittings, Classes 125 and 250 (Includes Revisions Service)                            |
| 19. | ASME B16.18      | - Cast Copper Alloy Solder Joint Pressure Fittings (Includes Revision Service)                               |
| 20. | ASME B16.22      | - Wrought Copper and Copper Alloy Solder-Joint Pressure Fitting (Includes Revision Service)                  |
| 21. | AWWA C151/A21.51 | - Ductile-Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids        |
| 22. | CISPI 301        | - Hubless Cast Iron Sanitary System  |
| 23. | CISPI 310        | - Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications |

### 1.3 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in the "Submittals" section of these specifications.
- B. Shop Drawings: Submit the following Shop Drawings.
  - 1. Submit complete detailed shop drawings in conformance with the specified requirements.
  - 2. Include drawings that show the piping layouts and schedules of all pipe, fittings, valves, expansion joints, flexible couplings, hangers, supports and other appurtenances.
  - 3. When any work is of special design show in large detail and completely describe and dimension.

### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle all products and materials as specified in the "Materials and Equipment" section of these specifications, and as follows:

## 1.5 PAYMENT

- A. Miscellaneous Pipe and Fittings will not be paid for separately but shall be included in the cost per L SUM for PUMP STATION.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

#### 1. Pipe and Fittings:

##### a. *Cast-Iron Soil Pipe and Fittings*

- (1) U.S. Pipe and Foundry Co., Birmingham, AL
- (2) Tyler Pipe Industries, Tyler, TX
- (3) Charlotte Pipe and Foundry, Charlotte, NC

##### b. Copper pipe and Fittings

- (1) Mueller Industries, Inc., Wichita, KS
- (2) Nibco, Elkhart, IN

##### c. PVC and CPVC Pipe and Fittings

- (1) Chemtrol, Division of Nibco, Indianapolis, IN
- (2) Asahi/America, Malden, MA

##### d. Wall Sleeve Annular Seals

- (1) Thunderline Corp. (Link-Seal), Belleville, MI

#### 2. Dielectric Insulating Fittings:

- a. Walter Vallett Co., Detroit, MI
- b. EPCO, Inc., Cleveland, OH

### 2.2 MATERIALS

#### A. Cast-Iron Soil Pipe and Fittings

- 1. Pipe and Fittings: Provide service weight, hub and spigot, cast-iron soil pipe and fittings meeting the requirements of ASTM A 74 or hubless cast iron soil

pipe and fittings meeting the requirements of CISPI 301. Do not use hubless pipe and joints for buried pipe.

2. Protective Coatings: Provide interior protective coatings (linings) and exterior protective coatings for pipe and fittings in the finished work as follows and as indicated in the piping schedules:
  - a. For pipe and fittings not exposed in the finished work, provide an interior bituminous lining and an exterior bituminous coating that meet AWWA C151/A21.51 requirements.
  - b. For pipe and fittings exposed in the finished work, provide an interior bituminous lining that meets AWWA C151/A21.51 requirements.
    - (1) If the pipe schedules indicate that the pipe exterior is to be painted, paint in accordance with the requirements in the "Painting" section of these specifications.
    - (2) If the pipe schedules indicate that the pipe exterior is to have a bituminous coating, coat the pipe in accordance with the requirements in AWWA C151/A21.51.
3. Joints: Provide lead and oakum joints or neoprene gasket, compression type joints in accordance with ASTM C 564 for hub and spigot pipe. Consult the piping schedules. Provide hubless couplings for hubless pipe. Compose hubless couplings of a stainless steel shield, clamp assembly and an elastomeric sealing sleeve conforming to CISPI 310.
4. Cleanouts: Provide cleanouts where shown or specified, unless otherwise specified.

#### B. Copper Pipe and Fittings

1. Small Copper Piping: For copper pipe 3 inches in diameter and smaller, provide Type K hard drawn copper tubing that meets ASTM B 88 requirements.
  - a. Fittings: Provide ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and copper alloy fittings.
  - b. Joints: Threaded or ASTM B 32 lead-free soldered joints.
2. Large Copper Piping: For copper pipe larger than 3 inches in diameter, provide regular seamless copper pipe that meets the ASTM B 42 requirements.
  - a. Fittings: Provide solder type fittings of the same material as the pipe.
  - b. Joints: Use threaded or brazed joints.

3. Potable Water Piping: Use ASTM B 32 alloy Grade 95TA (95 percent tin and 5 percent antimony) solder for piping carrying potable water.
  4. Unacceptable Uses: Do not use copper pipe with soldered joints for transporting fuel oil or other flammable or toxic liquids inside buildings.
- C. Polyvinyl Chloride (PVC) and Chlorinated Polyvinyl Chloride (CPVC) Pipe and Fittings
1. Pipe and Fittings: Provide PVC pipe and fittings that are Schedule 80 and meet the requirements of ASTM D 1784 Class 12454-B and ASTM D 1785 unless otherwise shown or specified. Provide CPVC pipe and fittings that are Schedule 80 and meet the requirements of ASTM D 1784 Class 23447-B and ASTM D 1785, unless otherwise shown.
  2. Joints: Provide ASTM D 2855 solvent welded joints utilizing ASTM D 2564 solvent cement or ASTM D 2464 threaded joints, as indicated in the piping schedules.
- D. Sleeves and Wall Castings for Miscellaneous Pipe and Fittings
1. Provide ductile iron sleeves and wall castings as shown. Provide steel sleeves as shown. Provide steel sleeves of Schedule 40 minimum thickness.
- E. Wall Sleeve Annular Seals: Provide modular mechanical type seals consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall sleeve. Provide an elastomeric element that is of the size, quantity, type and material that the manufacturer recommends for the intended service and that will provide an effective hydrostatic seal.
- F. Supports and Anchors: Provide all pipelines with supporting and anchoring devices as shown on the plans and as required.
- G. Drip Pans: Provide drip pans constructed of 16-gauge Type 304 stainless steel.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. General: Install all miscellaneous pipe and fittings in accordance with the specifications contained herein and in accordance with the manufacturer's recommendations and approved shop drawings and as specified in the "Submittals" section of these specifications.
- B. Connections Between Dissimilar Metals: Where connections are to be made between pipelines or equipment of corrosion causing dissimilar metals make the connections using dielectric insulating couplings, unions or other approved dielectric insulating devices.

- C. Couplings: Only use couplings to join standard lengths of pipe and as required to complete a straight run of pipe. Do not use couplings to join random lengths of pipe and cuttings from standard lengths.
- D. Reducing Fittings: Use reducing fittings for all changes in pipe size. Do not use bushings.
- E. Pipe Flexibility: Make ample provisions for flexibility in all pipelines.
- F. Drip Pans: Provide drip pans under all metallic pipelines installed over electrical equipment and motors and properly connect to the drainage system with 3/4-inch red brass pipe. Make leaktight connection between the drip pan and the drain pipe. Pitch pans uniformly toward the drain pipe not less than 1/8-inch per lineal foot.

### 3.2 CLEANING AND PAINTING

- A. Cleaning: Flush all process and potable water pipelines with clean water.
- B. Leakage: Test pipes at the pressures specified in the piping schedule located in the "Leakage Tests" section of these specifications.
- C. Paint in accordance with the "Painting" section of these specifications, unless otherwise specified.

**END OF SECTION**

## VALVES

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Requirements for furnishing and installing all valves and operators, except special regulating valves, telescopic valves, and flap valves.
1. Where valve operators are installed in NEC Class I, Group D, Division 1 or 2 hazardous locations (as specified), provide operator-related electrical equipment and appurtenances that are UL, Inc. approved for use in such areas.
  2. Provide valve operators complete, including a suitable enclosure, with all appurtenances necessary for the operator to perform its intended function. Such appurtenances include, but are not limited to, anchor bolts and other mounting hardware, control switches, limit switches, pressure switches, torque switches, gauges, control valves, electrical supply connections, internal electric wiring and controls, terminal blocks, air supply piping, solenoid valves, miscellaneous valves, regulating controls, push button controls, miscellaneous controls, extension stems, local and remote indicators, operating nuts, purge water service with all associated piping, indicating lights, floor boxes, direct burial valve boxes and other such items.
  3. For each valve, provide the type of operator specified for the valve in the Valve Schedule.
- B. Related Work Specified in Other Sections Includes:
1. Storm Water Pump Station
  2. Painting
  3. Miscellaneous Pipe and Fittings

#### 1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
1. ASME B1.20.1 - Pipe Threads, General Purpose
  2. ASME B1.20.7 - Hose Coupling Screw Threads
  3. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings
  4. ASTM A 27/A27M - Specification for Steel Castings, Carbon, for General Application
  5. ASTM A 29/A29M - Specification for Steel Bars, Carbon and Alloy, Hot Wrought and Cold-Finished, General Requirements

6. ASTM A 48 - Specifications for Gray Cast Iron Castings
7. ASTM A 126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
8. ASTM A 197 - Specification for Cupola Malleable Iron
9. ASTM A 276 - Specification for Stainless and Heat-Resisting Steel Bars and Shapes
10. ASTM A 278 - Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 F
11. ASTM A 395 - Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
12. ASTM A 436 - Specification for Austenitic Gray Iron Castings
13. ASTM A 479/A479M - Specification for Stainless and Heat Resisting Steel Wire Bars, and Shapes for Use in Boilers and Other Pressure Vessels
14. ASTM A 536 - Specification for Ductile Iron Castings
15. ASTM A 564/A564M - Hot Rolled and Cold Finished Age Hardening Stainless and Heat Resisting Steel Bars and Shapes
16. ASTM A 572/A572M - Specification for High Strength Low Alloy Columbium Vanadium Steels of Structural Quality
17. ASTM A 743/A743M - Specifications for Castings, Iron-Chromium, Iron-Chromium - Nickel, and Nickel-Base Corrosion-Resistant for General Application
18. ASTM A 744/A744M - Specification for Castings, Iron-Chromium-Nickel, Corrosion-Resistant, for Severe Service
19. ASTM B 30 - Specification for Copper Base Alloys in Ingot Form
20. ASTM B 62 - Specification for Composition Bronze or Ounce Metal Castings
21. ASTM B 148 - Specification for Aluminum-Bronze Castings
22. ASTM B 584 - Specification for Copper Alloy Sand Castings for General Applications
23. AWWA C500 - Metal Seated Gate Valves for Water and Sewerage Systems



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|-----|-----------|---|
| 24. | AWWA C502 | - Dry-Barrel Fire Hydrants  |
| 25. | AWWA C504 | - Rubber-Seated Butterfly Valves  |
| 26. | AWWA C508 | - Swing Check Valves for Waterworks Service, 2 inch through 24 inch NPS                               |
| 27. | AWWA C509 | - Resilient-Seated Gate Valves for Water Supply Service   |
| 28. | AWWA C540 | - Power-Actuating Devices for Valves and Sluice Gates   |
| 29. | MSS SP-70 | - Cast Iron Gate Valves, Flanged and Threaded Ends  |
| 30. | MSS SP-71 | - Cast Iron Swing Check Valves, Flanged and Threaded Ends   |
| 31. | MSS SP-80 | - Bronze, Globe, Angle and Check Valves   |
| 32. | NACM      | - Welded and Weldless Chain Specifications  |
| 33. | SAE J356  | - Welded Flash Controlled Low-Carbon Steel Tubing Normalized for Bending, Double Flaring, and Beading |
| 34. | SAE J524  | - Seamless Low-Carbon Steel Tubing Annealed for Bending and Flaring                                   |
| 35. | SAE J525  | - Welded and Cold-Drawn Low-Carbon Steel Tubing Annealed for Bending and Flaring                      |

### 1.3 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in the "Submittals" section of these specifications. .
- B. Shop Drawings: Submit the following:
  - 1. Complete detailed drawings of all valves
  - 2. Working drawings, including arrangement and erection drawings of the operators and control equipment; schematic control diagrams, electrical connection diagrams, and complete description of the control system; and operating characteristics
- C. Quality Control Submittals: Submit the following:
  - 1. If requested, manufacturer's certified performance and material records.

2. If requested, complete calculations for each size of motor operator indicating the force required to operate the valve, the operator force provided, full load and locked rotor current, and horsepower.

- D. Operation and Maintenance: Submit operation and maintenance manuals for the valve operators.

#### 1.4 QUALITY ASSURANCE

- A. Furnish all valves of the same type from the same manufacturer. Provide parts that are interchangeable for all valves of the same type and size.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store and handle all products as specified in the "Materials and Equipment" section of these specifications, and as follows.
- B. Historical Performance: Furnish and install eccentric plug valves of a type that has shown successful performance for a minimum of ten years. If requested, submit documentation of successful installations in which eccentric plug valves of the proposed type have been in operation for at least ten years.
- C. Tests: Furnish a letter confirming that all plug valves have been satisfactorily tested as specified, prior to shipment.
- D. Storage and Erection: Pack and store all valves in satisfactory operating condition. Carefully erect all valves in their respective positions, free from all distortion and strain.

#### 1.6 SPARE PARTS

- A. For each size cylinder:
  1. One set of packing
  2. One set of cup leathers or O-rings
  3. One needle valve (if used)
  4. One check valve (if used)
  5. One oil fog unit (if used)
  6. One hose (for swiveling type cylinders)
  7. One solenoid control valve
- B. For electric motor operators:
  1. One motor of each size
  2. One torque switch of each size
  3. One limit switch assembly of each size

4. Six push buttons
5. Six color caps of each color
6. Twenty indicating lamps
7. One reversing starter of each size
8. One overload relay of each size

## 1.7 PAYMENT

- A. Valves will not be paid for separately but shall be included in the cost per L SUM for PUMP STATION.

## PART 2 PRODUCT

### 2.1 MANUFACTURERS

- A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. AWWA Butterfly Valves:

- a. American Flow Control
- b. DeZurik
- c. Keystone
- d. Pratt

2. Eccentric Plug Valves – DeZurik, or approved equal

3. Single Disc Swing Check Valves:

- a. American Flow Control
- b. Clow Valve Company
- c. M&H Valve Company
- d. Mueller Company

4. Solenoid:

- a. Automatic Switch Company
- b. Magnetrol

5. Electric Motor Operator - Nonmodulating:

- a. E-I-M Company

- b. Limitorque Corporation
  - c. Rotork, Inc.
- 6. Electric Motor Operator - Modulating:
  - a. E-I-M Company
  - b. Limitorque Corporation
  - c. Rotork, Inc.

## 2.2 MATERIALS

### A. General:

- 1. Fabricate valves of materials resistant to corrosion for the required service.
- 2. Fabricate valves that are to be installed in metal pipelines and that are 2 inches in diameter and smaller of all brass or bronze, except fabricate the handwheel of ASTM A 197 malleable iron. Fabricate valves that are to be installed in metal pipelines and that are 2-1/2 inches in diameter and larger of the materials specified herein.
- 3. Fabricate gate, globe and angle valves with a minimum steam working pressure rating of 125 psig and a minimum nonshock cold water, oil or gas pressure rating of 200 psig, unless otherwise specified.
- 4. Fabricate operators of materials resistant to corrosion for the required services. Provide operator materials as specified.
- 5. Operator housings and pedestal handwheels:
  - a. Cast iron                      ASTM A 126, Class B  
  ASTM A 48, Class 30 or 35
  - b. Ductile iron                    ASTM A 395  
  ASTM A 536, Grade 65-45-12
  - c. Cast steel                      ASTM A 27/A27M
- 6. Operator worms, steel            ASTM A 29/A29M Grade  
  Designation 8620
- 7. Operator gears, steel  
   (spur & helical)                    ASTM A 572/A572M
- 8. Worm gears, bronze            ASTM B 148, Alloy C95400 or C95500  
  ASTM B 584, Alloy C86300

### B. Valve Joints

1. Fabricate valves 2 inches in diameter and smaller of the threaded or solder end type for valves to be installed in copper pipelines, and of the threaded end type for valves to be installed in metal pipelines.
  2. Fabricate all valves 2-1/2 inches in diameter and larger, except bronze valves 2-1/2 and 3 inches in diameter, with flanged ends, unless otherwise specified.
  3. Fabricate bronze valves 1-1/2 and 3 inches in diameter with solder or threaded type ends for valves installed in copper pipelines and threaded type ends for all other pipelines.
  4. For metallic flanged joints, provide flanges that are faced accurately at right angles to the axis of the casting. Face and drill flanges and shop coat with a rust-preventive compound before shipment.
  5. For flanged joints, provide flanges whose dimensions and drillings meet the requirements of ASME B16.1, 125 pounds as a minimum. For valves installed in pipelines with test pressure requirements higher than 125 psi, provide flanges whose pressure ratings equal or exceed the specified test pressure of the pipeline. Furnish special drillings where required. For valves having flanges that do not conform with the thickness requirements of ASME B16.1, test each valve in accordance with the hydrostatic shell test pressure requirements of ASME B16.1.
- C. Operating Force: Fabricate valves to limit the maximum force required to operate all manual valves, including but not limited to valves with wrench operated nuts, levers, handwheels and chainwheels, to 40 pounds. Limit the overall length of each wrench or single-arm lever to 18 inches. Limit the overall length of each dual-arm lever to 36 inches.
- D. Handwheel: Mark each valve handwheel with an arrow and the word OPEN. Mark each nut with an arrow.
- E. Manually Operated Valves: Equip all manually operated valves that have operating nuts, levers or handwheels and that are more than 7 feet above the floor with chain operated levers or chainwheels. Extend chains to 7 feet above the floor.

## 2.3 BUTTERFLY VALVES

- A. General:
1. Provide butterfly valves 4 inches and smaller of the full lug pattern with drilled and tapped bolt holes.
  2. Provide butterfly valves 6 inches and larger of the full flanged pattern that meet the requirements of AWWA C504.
  3. Provide butterfly valves of the rubber-seated, tight-closing type.

4. For fluid temperatures equal to or less than 180 degrees F, provide Buna-N seats. For fluid temperatures greater than 180 degrees F, provide EPDM or Viton seats. For fluid temperatures exceeding the temperature ratings of EPDM and Viton, provide seats that are appropriate for the intended service.

B. Materials:

1. For butterfly valves 4 inches and smaller, provide valve materials as specified below or as required for the service.
  - a. Valve bodies:
 

Cast iron	ASTM A 126, Class B
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  - b. Valve shafts:
 

Stainless steel	ASTM A 564, Type 630 (17-4 PH stainless steel)
	ASTM A 276 Grade 316
  - c. Valve discs:
 

Aluminum Bronze	ASTM B 148
Bronze	ASTM B 30
  - d. Bearings:
 

	TFE coated stainless steel
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2. For butterfly valves 6 inches and larger, provide valve materials as specified below or as required for the service:
  - a. Valve bodies:
 

Cast iron	ASTM A 126, Class B
	ASTM A 48, Class 40
  - b. Valve shafts: ASTM A 276 or A 479/A479M, Type 304, stainless steel or carbon steel with A 276 or A 479, Type 304 stainless steel journals
  - c. Valve discs:
 

Cast iron	ASTM A 48, Class 40
Alloy cast iron	ASTM A 436, Type 1
Ductile iron	ASTM A 536, Grade 65-45-12
Bronze	AWWA C504 Grade A, D or E
  - d. Mating seat surface:
 

Stainless steel (castings)	ASTM A 743/A743M, A 744 Grade CF-8 or CF-8M
Stainless steel	ASTM A 276 or A479, Type 304
Alloy cast iron	ASTM A 436, Type 1
  - e. Seats:
 

	Buna-N (Wastewater)
	New natural rubber or Buna-N (Water)

### Neoprene (Air)

- C. General AWWA C504 Construction: For butterfly valves 6 inches and larger, manufacture valves and all accessories, including operators, to meet the requirements of AWWA C504, except as otherwise specified. Provide valve bodies of the short-body flanged type or mechanical joint-end type, as shown or specified. Wafer body type valves without lugs are not acceptable.
- D. Pressure: Provide butterfly valves of pressure classes that are not less than Class 25B, that exceed the pipeline test pressure in which the valve is installed, or that are as specified, whichever is greater.
- E. Shafts: If stub shafts are furnished, extend the shafts a minimum of 1-1/2 diameters into the discs and provide clearance between the shaft and discs not exceeding the following:

<u>Shaft Diameter (Inches)</u>	<u>Maximum Radial Clearance (Inches)</u>
1/2 to 1-1/2	.002
2 to 4	.0025
5	.003
6	.004

- F. Extended Necks: Provide butterfly valves in insulated lines with extended necks to clear insulation.

## 2.4 ECCENTRIC PLUG VALVES

- A. General: Provide quarter turn valves having an eccentric action that causes the plug to rise off the seat contact during the opening movement rather than sliding from its seat.
- B. Plugs: Provide plug valves with Buna-N faced plugs.
- C. Materials: Construct plug valves of cast iron or semi-steel at least equal to ASTM A 126, Class B. For valve sizes 3-inch and larger, construct the body seats with a welded-in overlay, of not less than 90 percent pure nickel, on all surfaces contacting the plug face. For valve sizes under 3-inch provide uncoated or epoxy coated body seats. Make the overlay a minimum of 1/16-inch thick for valve sizes 20-inch and smaller and a minimum of 1/8-inch thick for valve sizes 24-inch and larger. Provide zinc plated bonnet bolts, studs and nuts.
- D. Seat Adjustment: Make the water-tightness or gas-tightness of the valve seating adjustable. Provide a seating adjustment device that is external to the valve and that can be used without the need to remove the valve from the piping and with the valve under pressure.
- E. Lubrication: Furnish plug valves with oil impregnated, permanently lubricated, Type 316 stainless steel bearings in the upper and lower journals.

- F. Stem Seal: Provide a stem seal consisting of multiple, self-adjusting and replaceable chevron type packing rings and a packing gland or provide two replaceable, self-adjusting, U-cup seals. Make the stem seal adjustable and replaceable without removing the valve from the piping and without the need to disassemble the valve and operator. For buried or submerged service, provide a sealed enclosure to keep the stem seal clean.
- G. Valve Port: Unless otherwise specified, construct the valve with a minimum port area of 80 percent of the full area of the pipe in which the valve is installed.
- H. Position Indicator: Equip plug valves, except for buried or submerged service, with external visible indication of the plug position.
- I. Operators: Unless otherwise shown or specified, equip 6-inch and smaller valves with wrench or lever operators and 8-inch and larger valves with gear operators. Equip all valves in low pressure gas service with gear operators. Furnish one wrench for each size valve in each individual room or space in which valves are located. House gear operators for submerged or buried service in a watertight enclosure. For buried or submerged service, equip valve operators with stainless steel external bolting.

## 2.5 SINGLE DISC SWING CHECK VALVES

- A. General: Provide single disc swing check valves designed to allow a full diameter passage and to operate with a minimum loss of pressure. Provide 1/8 through 3 inch check valves that meet the requirements of MSS SP-80. Except as specified herein, provide 4 inch through 24 inch check valves that meet the requirements of AWWA C508. For heating, ventilating or air conditioning service, provide 4 inch through 24 inch check valves that meet the requirements of MSS SP-71.
- B. Design: Equip check valves with bronze renewable seat rings, bronze discs or disc rings and bronze disc hinge bushings and pins. Carefully mount discs and provide discs that swivel in disc hinges. Provide pins, discs and other parts that are noncorrosive, nonsticking and properly cured to operate satisfactorily within a temperature range of 34 to 100 degrees Fahrenheit and with the fluids or gases specified.
- C. Levers and Weights: Equip 6 inch and larger check valves with outside levers and weights.

## 2.6 SOLENOID VALVES

- A. Provide solenoid valves of the direct acting, all electric, normally closed, packless type with full area ports, unless otherwise shown or specified. Design valves to not require a pressure assist from the process fluid to open or close. Size the solenoids in accordance with the pressure conditions in the pipeline in which valves are installed. Construct the valve body and bonnet of forged brass and construct the solenoid core of stainless steel. Design solenoid the coils for 115-volt, 60-hertz operation. Embed solenoid coils in molded plastic and install coils in NEMA Type 1 general purpose enclosures, except as shown or specified.



## 2.7 MANUAL BUTTERFLY VALVE OPERATORS

- A. General: Provide operators as an integral part of the valve. Manufacture manual operators of the enclosed, hand-lever, traveling-nut or worm-gear type, as shown or specified.
- B. Hand-Lever Type: Fabricate hand-lever type operators of cast-iron or steel construction with a nonmetallic, nonslip handgrip. Equip the lever with a locking device to secure the valve disc in the fully open or fully closed position, or at a minimum of 5 intermediate positions at 18° intervals. Provide mechanical stop-limiting devices to prevent overtravel of the disc in either direction. Permanently lubricate operators or provide operators with grease fittings.
- C. Traveling-Nut Type: Fabricate traveling-nut type operators with a threaded steel screw and a bronze nut. Provide a slotted-lever or link-lever system to transfer the applied torque to the disc shaft. Equip all rotating shafts, screws and links with separate bearings. Provide thrust bearings.
- D. Worm-Gear Type: Fabricate worm-gear type operators with a worm gear and matching drive worm. Provide bearings for each rotating member.
- E. Stop-Limiting Devices: Provide stop-limiting devices on traveling-nut and worm-gear type operators to prevent overtravel of the disc in either direction. Design the operator to hold the disc in any position without flutter or wear on the valve or operator. House the operator in a watertight enclosure. Pack operators with grease or with oil. For buried or submerged service, equip valve operators with stainless steel external bolting.
- F. Position Indicators: For buried or submerged service, equip manually operated butterfly valves, with externally visible indication of the disc position.

## 2.8 CHAINWHEEL OPERATORS

- A. General: Manufacture chainwheels and chain guides of cast iron or ductile iron.
- B. Chains: Manufacture chain of steel. Use welded link chain meeting the requirements of the National Association of Chain Manufacturers (NACM) Grade 28 or single loop weldless chain meeting the requirements of NACM No. 6001. Remove excess metal at welded chain joints for proper fit into the chainwheel pockets. Remove burrs and sharp edges. Furnish chain that is suitable for bare hand operation.

## 2.9 FLOOR AND BENCH STANDS

- A. General: Provide floor and bench stands for valves smaller than 12 inches of the wheel operated type without gears. Provide stands for 12- to 20-inch valves of single crank, single speed operated. Provide stands for 24-inch and larger valves of single crank, single speed or 2-speed operated as specified.
- B. Materials: Use materials in floor and bench stands meeting the applicable requirements of the "General" specifications subsection. Provide frames of cast iron

or fabricated steel of heavy and substantial design with smooth exterior and neat appearance. Make adequate provision for lubrication and protect all operating parts.

- C. Nameplate and OPEN Indication Marking: Equip each stand with a nameplate stating the valve controlled by the stand and also stamp the operator with an arrow and the word OPEN to indicate the direction of rotation.
- D. Rising Stems: Fit rising stem floor and bench stands with ball or roller bearings designed to take the thrust. Equip rising stem stands with a transparent plastic cover to protect the stem. Provide the cover with labels and other attachments that will facilitate its use as an indicator of valve position.
- E. Nonrising Stems: Fit nonrising stem floor and bench stands with thrust ball or roller bearings. Provide an indicator to show the position of the valve.
- F. Operating and Lift Nuts: Provide operating nuts or lift nuts of bronze meeting the requirements of ASTM B 62, finished all over, suitably splined to connect with the handwheel or gear and with threads which will engage smoothly with those of the lifting shaft.
- G. Crank-Operated Stands: Provide crank-operated stands with a crank that will open the valve when the crank is turned counterclockwise. Locate the center of the crank approximately 36 inches above the operating floor. Provide gears which are bevel or worm, of hardened steel or manganese bronze, with machine cut teeth and enclosed in a cast-iron body. Equip the crank with a brass or bronze sleeve-type handgrip rotating freely on the handle. Utilize a gear ratio that will enable the stand to operate the valve with a maximum force of 40 pounds on the crank at single or low speed.
- H. Handwheel-Operated Stands: Provide handwheel-operated stands with handwheels that open the valve when the wheel is turned counterclockwise. Locate the center of the handwheel approximately 36 inches above the operating floor. Provide a handwheel of sufficient diameter so that the stand will operate the valve with a maximum pull on the handwheel of 40 pounds.
- I. Manually Operated Bench Stands: Equip manually operated bench stands located more than 7 feet above the floor with chains and chainwheels that meet the requirements of the subsection headed "Chainwheel Operators".

## 2.10 ELECTRIC MOTOR OPERATORS - NONMODULATING

- A. General: Provide nonmodulating electric motor operators of the close-coupled, electric motor-driven, worm gear type, complete with motor, gearing, limit switches and auxiliary contacts, torque switches, position indicator, handwheel, integral controller, and all required appurtenances. Design the operators to rotate valve discs through 90 degrees from the fully open to the fully closed position and back, as in butterfly, ball or plug valves, and lift gate discs from the fully closed to the fully open position and back, as in gate valves. Provide operators that complete each operation in the time specified. Provide operators that hold the discs in any position from fully open to fully closed without vibration.

- B. Operator Mounting: Design the operator to be mounted in the position shown or specified.
- C. Standard: Except as otherwise specified, provide operators meeting AWWA C540.
- D. Open and Close Time Periods: Provide valve operators that fully open the valve from the closed position in approximately 30 seconds and fully close it in approximately 30 seconds when the differential pressure and flow are at the values specified for the valve and the voltage at the terminals is within 15 percent of the nominal voltage. Design the operator to operate the valve through three consecutive opening and closing cycles or for a period of 15 minutes, whichever is longer, during every 60-minute period, at specified ambient temperature conditions under full differential pressure.
- E. Temperature Range: Design the operator for outdoor operation and for an ambient temperature range of -20 to 140 degrees F.
- F. Torque: Design the operator to exert an unseating torque of at least 50 percent in excess of the required disc seating torque at the specified voltage, neglecting hammer-blow effect.
- G. Power Gearing: Provide power gearing consisting of helical or spur gears and worming gearing. Fabricate helical and spur gears of accurately machined hardened alloy steel. Provide a hardened alloy steel worm with threads ground and polished after heat-treating. Provide a nickel or manganese bronze worm gear. Use antifriction bearings throughout. Grease pack or oil bath lubricate the operator. Provide lubricants suitable for the ambient temperatures specified.
- H. Lost-Motion Device: Design operators for gate valves to include a lost-motion device that will permit the motor to attain full speed, and then impart a hammer blow to the stem nut to start movement of the disc in both the opening and closing directions. Do not include this feature if the valve is for modulating service.
- I. Handwheel - Manual Operation: Provide a handwheel for manual operation with a maximum rim pull of 40 pounds. Design the handwheel so that it does not rotate during electrical operation and the motor does not rotate during manual handwheel operation. Provide an operator that is arranged so that motor or motor gearing failure does not prevent manual operation. Arrange the operator to automatically change from manual operation to electrical operation when its motor is energized and to continue electric operation until the operator is reset to manual operation. Provide a means for locking the drive in either manual or motor operation. Provide removable handwheels. Provide an adaptor key or drive nut to permit operation by a portable operator.
- J. Declutching Mechanism: Provide a declutching mechanism to disengage the motor mechanically but not electrically from motor to handwheel operation. If the clutch is of the external lever type, arrange it such that the lever does not move when the motor is energized.
- K. Position Indication: Provide an operator-mounted disc position indicator of the mechanical or indicating light type. For OPEN-CLOSED service, indicate the fully

open, fully closed and intermediate disc position either mechanically or by lights. For modulating or throttling service, provide continuous disc position indication between the fully open and fully closed positions. Provide electrical contacts as required for remote indication of disc position.

- L. Electric Motor Design: Provide an operator motor of the high torque, ball or roller bearing, squirrel-cage type designed for continuous valve duty. Provide motor rated for 15 minute duty cycle or three complete opening and closing valve strokes, whichever is longer, during a 60 minute period under full differential pressure at 40 degrees C ambient. Design the motor for use on a nominal 480 volts, 3-phase, 60-hertz electrical service. Provide motor windings and leads with Class F or better insulation with built-in thermal overload protection.
- M. Housing: Provide housings for controls, gears, and motors with integrally cast flanges. Fully machine and template drill the flanges and their mating surfaces. Provide joints which are metal-to-metal or gasket or O-ring sealed as required.
- N. Control and Motor Enclosures: Provide NEMA 4 control and motor enclosures, except as otherwise specified. Provide NEMA 7 enclosures where explosion-proof construction is shown or specified. Provide the controller with mechanical interlocks and mount as an integral part of the operator. For explosion-proof enclosures that are dependent upon metal-to-metal faces for weatherproofing, include explosion-proof breathers and drains with desiccant type dehumidification and with sufficient silica gel desiccant for 6 months service without requiring renewal. Include instructions for renewal of the desiccant. Provide a 2-year supply of desiccant.
- O. Electrical Compartment Heater: Provide electrical compartment heaters, unless otherwise specified.
- P. Electrical Requirements: Provide electrical controls for the operator as shown or specified. Design operators for 480-volt, 3-phase, 60-hertz service. Design all control circuits for 120-volt, single-phase, 60-hertz ac. Provide an integral 480/120-volt control transformer with fused secondary.
- Q. Reversing Controller, Overload Protection and Internal Wiring: Provide a NEMA rated reversing controller, or an approved special duty rated reversing controller, complete with mechanical interlocks and controls as an integral part of the operator. Provide adequate overload protection in the controller or embedded in the motor windings. Install an overload device in each phase. If overload devices are installed in the motor windings, provide devices of the bimetallic automatic reset type with the contacts in the control circuit. Arrange the internal wiring in the operator so that the opening and closing coils cannot be energized simultaneously at any time, regardless of external wiring conditions.
- R. Push Buttons and Selector Switches: Where operators are 7 feet or closer to the floor and in an accessible location, mount OPEN- STOP-CLOSE push buttons or a selector switch as shown on the operator housing. Also mount red and green position indicator lights and, where shown or required, an amber ready light or MANUAL-AUTO mode selector on the operator housing. Where the operators are located over 7 feet from the floor or in an inaccessible location, connect all internal control and indication wiring to

a terminal block within the operator enclosure and provide a separate control station for remote mounting. Provide the remote control station with the same NEMA rating as the operator.

- S. Limit and Torque Switches: Provide the operator with limit and torque switches, either direct or gear driven. Provide adjustable limit and torque switches with auxiliary contacts that are operative in either direction of travel. Provide limit switches that are "in step" with torque switches at all times, whether in motor or manual operation. Equip the operator with limit switches to stop movement in each direction and torque switches for protection against mechanical overload and to stop movement in either direction if an obstruction is encountered. Provide the number, function and arrangement of limit switches as shown, specified or required.
- T. Additional Accessories: Provide additional limit switches, indicating lights, position transmitters and remote position indicators, remote operating controls and other accessories and controls as shown, specified or required.

## 2.11 ELECTRIC MOTOR OPERATORS - MODULATING

- A. General: Provide modulating motor operators that meet the requirements for nonmodulating operators, except as specified herein. In addition to the other equipment specified for nonmodulating operators, provide an electronic control module and a solid state reversing starter.
- B. Control Module: Provide a solid-state type control module with a comparator circuit which senses the error between the input command signal and the position feedback signal. Mount the control module within the operator switch compartment.

Accept a 4-20 mA<sub>dc</sub> input command signal. Provide zero and span adjustments to align minimum and maximum valve position with zero and 100 percent values of the input command signal. Provide deadband adjustment from 0.16 to 1.0 percent to eliminate excessive motor movement due to minor variation in the process variable signal.

Activate the solid state reversing starter to drive the actuator in the proper direction necessary to reduce the error to zero. Provide proportional band adjustment from 5-40 percent. When the error is outside the proportional band, run the actuator motor continuously toward set point. When the error is within the proportional band, pulse the actuator motor toward set point to prevent overshoot.

Provide actuator to open the valve when command input signal increases.

On loss of command input signal, have valve fail in last position. On loss of feedback signal, have valve fail in last position.

- C. Selector Switch and Push Buttons: Where the operator is 7 feet or less from the floor and in an accessible location, integrally mount a 3-position AUTO-OFF-MANUAL selector switch plus two push buttons marked OPEN and CLOSE on the operator housing. Where the operator is located more than 7 feet from the floor or in an inaccessible location, connect all internal control and indication wiring to a terminal block and provide a separate control station for remote mounting.

- D. Auto and Manual Operations: Provide operators that, when in the AUTO position, will respond to the automatic signal as described above. Provide operators that, when in the MANUAL position, will be operable by either push buttons or handwheel.
- E. Motor Design: Design the motor specifically for valve operator service and to be continuous rated for continuous modulating duty. Provide motor insulation of at least Class H.

## 2.12 EXTENSION STEMS, VALVE BOXES AND FLOOR BOXES

- A. Equip all direct burial valves and valves in vaults or manholes with operating nuts and extended shafts to grade, unless otherwise shown or specified. Equip all direct burial valves with adjustable type, cast-iron, valve boxes and extended shafts to grade. Equip all valve boxes and floor boxes with ground level valve position indicators, unless otherwise shown or specified. Provide two tee wrenches for each size and type of operating nut.

## 2.13 SOURCE QUALITY CONTROL

- A. Eccentric Plug Valve Leakage Test: Perform a plug leakage shop test on each eccentric plug valve with the plug in the closed position. Unless otherwise specified, perform the leakage test with a minimum pressure of 150 pounds per square inch (gauge) applied sequentially to both the upstream and downstream faces of the plug. Perform the test for a minimum duration of 15 seconds. Demonstrate that there is no leakage past the plug.
- B. Eccentric Plug Valve Hydrostatic Test: Give each eccentric plug valve hydrostatic shop pressure tests with the plug open and with the plug closed. Perform the hydrostatic tests with a minimum pressure that is at least equal to the test pressure specified for the pipeline in which the valve is installed. Perform the test for a minimum duration of 30 seconds. Demonstrate with the hydrostatic tests that the valve is structurally sound and that there are no leaks through the external surfaces of the valve.
- C. Hydraulic Power Unit Shop Test: Prior to shipping the fluid power unit, conduct a shop test that demonstrates that the unit fulfills the operating requirements of the Specifications.

# PART 3 EXECUTION

## 3.1 INSTALLATION

- A. General: Install valves in accordance with the manufacturer's recommendations and approved shop drawings and as specified in the "Submittals" section of these specifications.
- B. Eccentric Plug Valves: Unless otherwise shown or specified for eccentric plug valves installed in horizontal piping, orient the valve such that the shaft is in the horizontal position, the seat is in the downstream position and when the valve is in the open

position the plug is up. Unless otherwise shown or specified, for eccentric plug valves installed in vertical piping, orient the valve with the plug up when the valve is in the closed position.

- C. Floor and Bench Stands: Accurately center floor and bench stands over the valve. Solidly bolt stands to the floor or support structure, with through-bolts wherever possible. Place approximately 3/4 inch of nonshrink cement grout beneath stands mounted on concrete or similar construction to assure uniform support. For stands installed within the area of a removable type floor, platform, or grating, securely mount them on their own support structure independent of the removable element, unless otherwise shown or specified.

### 3.2 PAINTING AND COATING

- A. General: Unless otherwise specified, coat the inside iron or steel surfaces of all valves and exterior surfaces of valves and operators that are to be buried in the ground or immersed in sewage or water with two coats of asphalt varnish. Paint exterior surfaces of other valves and operators as specified in the "Painting" section of these specifications.

### 3.3 FIELD QUALITY CONTROL

- A. Tests: After installation of the valves, control equipment and all appurtenances, subject the units to a field running test under actual operating conditions. Operate each valve through one complete open-close cycle under the maximum pressure differential practical.

### 3.4 OPERATION DEMONSTRATION

- A. Manufacturer's Field Services: Furnish the services of a qualified representative of each of various manufacturer's to demonstrate the proper operation and instruct plant personnel in the equipment's operation and maintenance.

### 3.5 PAINTING

- A. Paint the equipment in accordance with the requirements in the "Painting" section of these specifications.

**END OF SECTION**